Volunteer Lake Assessment Program Individual Lake Reports

WARREN LAKE, ALSTEAD, NH

MORPHOMETRIC DATA

Watershed Area (Ac.):	3,237	**Max. Depth (m):**	4.2	**Flushing Rate (yr^{-1})**	4.2
Surface Area (Ac.):	185	**Mean Depth (m):**	2	**P Retention Coef:**	0.57
Shore Length (m):	5,500	**Volume (m^3):**	1,503,500	**Elevation (ft):**	1200

TROPHIC CLASSIFICATION

Year	Trophic class
1991	OLIGOTROPHIC
2005	MESOTROPHIC

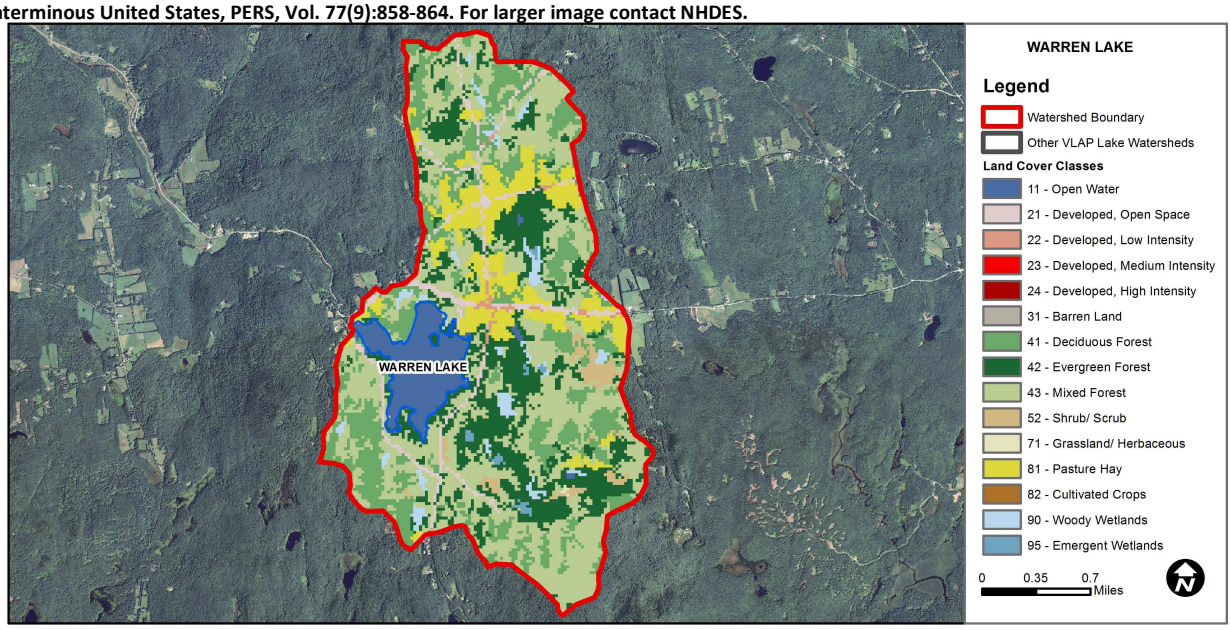
KNOWN EXOTIC SPECIES

The Waterbody Report Card tables are generated from the 2012 305(b) report on the status of N.H. waters, and are based on data collected from 2001-2011.

Designated Use	Parameter	Category	Comments
Aquatic Life	Phosphorus (Total)	Slightly Bad	>/=5 samples and median is >threshold.
	pH	Bad	>10%, with a minimum of 2, samples exceed criteria, with 1 or more by a large margin.
	D.O. (mg/L)	Very Good	At least 10 samples with 0 exceedances of criteria.
	D.O. (% sat)	Encouraging	< 10 samples and no exceedance of criteria. More data needed.
	Chlorophyll-a	Slightly Bad	>5 samples and median is > threshold.
Primary Contact Recreation	E. coli	Very Good	All bacteria samples <75% of geometric mean criteria, but not enough to calculate geometric mean. Or, all bacteria samples are < single sample criteria and calculated Geometric means are less than geometric mean criteria.
	Chlorophyll-a	Very Good	At least 10 samples with 0 exceedances of criteria.

WATERSHED LAND USE SUMMARY

Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PERS, Vol. 77(9):858-864. For larger image contact NHDES.

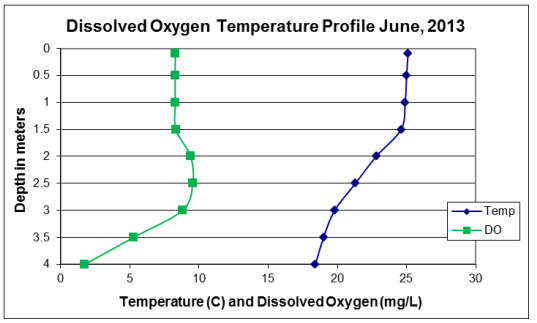


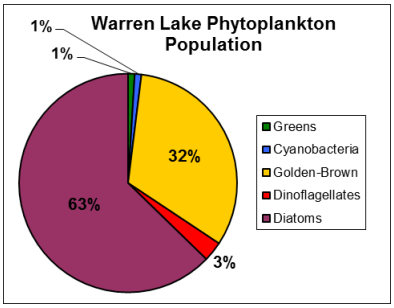
Land Cover Category	% Cover	Land Cover Category	% Cover	Land Cover Category	% Cover
Open Water	6.52	Barren Land	0	Grassland/Herbaceous	0.04
Developed-Open Space	3.66	Deciduous Forest	19.12	Pasture Hay	10.13
Developed-Low Intensity	0.58	Evergreen Forest	19.45	Cultivated Crops	0
Developed-Medium Intensity	0	Mixed Forest	35.78	Woody Wetlands	2.31
Developed-High Intensity	0	Shrub-Scrub	1.88	Emergent Wetlands	0.44

VOLUNTEER LAKE ASSESSMENT PROGRAM INDIVIDUAL LAKE REPORTS
WARREN LAKE, ALSTEAD, NH
2013 DATA SUMMARY

OBSERVATIONS AND RECOMMENDATIONS (*Refer to Table 1 and Historical Deep Spot Data Graphics)*

- **CHLOROPHYLL-A:** Chlorophyll levels were the highest measured since monitoring began. June levels were elevated, July levels indicate an algal bloom occurred and phytoplankton data confirm it was a Diatom bloom. By August, levels had decreased but remained above the state median. Historical trend analysis indicates relatively stable chlorophyll with low variability between years.
- **CONDUCTIVITY/CHLORIDE:** Deep spot conductivity and chloride were slightly greater than the state medians and historical trend analysis indicates significantly decreasing (improving) epilimnetic conductivity since monitoring began. We hope to see this continue! Dam Brook, Pickerel Cove Brook and Smith Hill Brook conductivity and chloride were slightly less than or equal to the state medians. Carmen Cove and Colburn Hill Brooks conductivity were slightly greater than the state median. Spruce River conductivity and chloride were elevated and greater than the state medians.
- **E. COLI:** Boat Landing and Ediths Beach E. coli levels were well below state standards for public beaches and surface waters.
- **TOTAL PHOSPHORUS:** Epilimnetic phosphorus was elevated in July and average levels increased greatly from 2012. Historical trend analysis indicates relatively stable epilimnetic phosphorus with high variability between years. Hypolimnion, Colburn Hill Brook, Dam Brook, Outlet, and Pickerel Cove Brook phosphorus levels were within historical average ranges. Carmen Cove Brook, Smith Hill Brook and Spruce River phosphorus levels were elevated in June following significant rain events.
- **TRANSPARENCY:** Average transparency was lower than 2012 due to the elevated algal growth. Transparency measured with the viewscope was much better than without and likely a more accurate measurement of conditions. Historical trend analysis indicates stable transparency with low variability between years.
- **TURBIDITY:** Epilimnetic and hypolimnetic turbidity were elevated in July due to the algal bloom. Carmen Cove Brook turbidity was elevated in June following significant rain event. Dam Brook turbidity was slightly elevated in June and July.
- **PH:** Deep spot pH levels were less than desirable range 6.5 – 8.0 units in July during the algal bloom. Photosynthetic by-products may have caused the reduction in pH. Historical trend analysis indicates stable epilimnetic pH with low variability between years.
- **RECOMMENDED ACTIONS:** The improving epilimnetic conductivity trend is a great sign. The Spruce River station contributes the highest conductivity and chloride and efforts should be made to try and reduce chloride levels. Stormwater runoff from significant summer rain events likely provided the nutrients necessary to fuel the elevated algal growth. The increased frequency and intensity of storm events highlights the need to reduce stormwater runoff. Continue watershed management plan development and implementation to identify and reduce phosphorus sources in the watershed. Keep up the great work!





NH Water Quality Standards: Numeric criteria for specific parameters. Results exceeding criteria are considered a water quality violation.
Chloride: < 230 mg/L (chronic)
E. coli: > 88 cts/100 mL – public beach
E. coli: > 406 cts/100 mL – surface waters
Turbidity: > 10 NTU above natural level
pH: 6.5-8.0 (unless naturally occurring)

NH Median Values: Median values for specific parameters generated from historic lake monitoring data.
Alkalinity: 4.9 mg/L
Chlorophyll-a: 4.58 mg/m^3
Conductivity: 40.0 uS/cm
Chloride: 4 mg/L
Total Phosphorus: 12 ug/L
Transparency: 3.2 m
pH: 6.6

Table 1. 2013 Average Water Quality Data for WARREN LAKE

Station Name	Alk. mg/l	Chlor-a ug/l	Chloride mg/l	Cond. uS/cm	E. Coli #/100ml	Total P ug/l	Trans. m NVS	Trans. m VS	Turb. ntu	pH
Boat Landing					10					
Carmen Cove Brook			10	58.8		19			1.09	6.55
Colburn Hill Brook			4	54.7		11			0.53	6.76
Dam Brook			3	40.8		11			1.52	6.77
Ediths Beach					8					
Epilimnion	4.40	9.80	8	46.6		13	2.03	3.25	1.14	6.45
Hypolimnion				47.8		14			1.35	6.47
Outlet				53.8		11			0.91	6.80
Pickeral Cove Brook			4	32.1		12			0.29	6.34
Shadowlands				41.3		13			1.41	6.26
Smith Hill Brook			3	18.7		17			0.67	5.86
Spruce River			36	150.4		16			0.71	6.31

HISTORICAL WATER QUALITY TREND ANALYSIS

Parameter	Trend	Explanation	Parameter	Trend	Explanation
pH	Stable	Trend not significant; data show low variability.	Chlorophyll-a	Stable	Trend not significant; data show low variability.
Conductivity	Improving	Data significantly decreasing.	Transparency	Stable	Trend not significant; data show low variability.
			Phosphorus (epilimnion)	Stable	Trend not significant; data highly variability.